

Appl. No. 10/010,858
Amdt dated: March 17, 2005
Reply to Office Action of December 17, 2004

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

Claim 1 (original): An electrode material comprising a surface/chemically modified positive electrode (cathode) material, wherein the surface/chemical modification is a ceramic.

Claim 2 (previously presented): The composition of claim 1, wherein the surface/chemical modification is $\text{Li}_x\text{Ni}_{1-y}\text{M}_y\text{O}_2$, where $0 \leq x \leq 1$, $0 \leq y \leq 1$, and $\text{M} = \text{Mg, Al, Ti, V, Cr, Fe, Co, Cu, Zn, and Ga}$.

Claim 3 (previously presented): The composition of claim 1, wherein the positive electrode (cathode) material is LiMn_2O_4 .

Claim 4 (canceled)

Claim 5 (withdrawn): The composition of claim 1, wherein the positive electrode (cathode) material is LiCoO_2 .

Claim 6 (original): The composition of claim 1, wherein the surface/chemical modification material is $\text{Li}_x\text{Ni}_{1-y}\text{Co}_y\text{O}_2$, where $0 \leq x \leq 1$; $0 \leq y \leq 1$.

Claim 7 (withdrawn): The composition of claim 1, wherein the surface/chemical modification material is Al_2O_3 .

Claim 8 (withdrawn): The composition of claim 1, wherein the surface/chemical modification material is MgO .

Claim 9 (withdrawn): The composition of claim 1, wherein the surface/chemical modification material is MgAl_2O_4 .

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Claim 10 (withdrawn): The composition of claim 1, wherein the surface/chemical modification material is $\text{Li}_{1.05}\text{Mn}_{1.9}\text{Ni}_{0.05}\text{O}_4$.

Claim 11 (withdrawn): The composition of claim 1, wherein the surface/chemical modification material is Cr_2O_3 .

Claim 12 (previously presented): An electrode material comprising a LiMn_2O_4 spinel oxide having been surface/chemically modified with a surface/chemical modification material $\text{Li}_x\text{Ni}_{1-y}\text{Co}_y\text{O}_2$, where $0 \leq x \leq 1$; $0 \leq y \leq 1$.

Claim 13 (currently amended): The composition of claim 12, wherein the surface/chemical modification material is $\text{Li}_x\text{Ni}_{1-y}\text{Co}_y\text{O}_2$, where $0 \leq x \leq 1$; $0 \leq y \leq 1$.

Claim 14 (withdrawn): The composition of claim 11, wherein the surface/chemical modification material is Al_2O_3 .

Claim 15 (withdrawn): The composition of claim 11, wherein the surface/chemical modification material is MgO .

Claim 16 (withdrawn): The composition of claim 11, wherein the surface/chemical modification material is MgAl_2O_4 .

Claim 17 (withdrawn): The composition of claim 11, wherein the surface/chemical modification material is Cr_2O_3 .

Claim 18 (withdrawn): An electrode material comprising a LiCoO_2 layered oxide having been surface/chemically modified with a surface/chemical modification material $\text{Li}_{1+x}\text{Mn}_{2-x-y}\text{M}_y\text{O}_4$ where $0 \leq x \leq 0.33$, $0 \leq y \leq 2$ and $\text{M} = \text{Ni}$ or Co .

Claim 19 (withdrawn): The composition of claim 17, wherein the surface modification material is Al_2O_3 .

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Claim 20 (withdrawn): The composition of claim 17, wherein the surface modification material is $\text{Li}_{1.05}\text{Mn}_{1.9}\text{Ni}_{0.05}\text{O}_4$

Claim 21 (withdrawn): An electrode material preparation method comprising:
supplying a LiMn_2O_4 spinel oxide electrode material;
mixing the LiMn_2O_4 spinel oxide electrode material with a surface/chemical modification material selected from a group consisting of $\text{Li}_x\text{Ni}_{1-y}\text{Co}_y\text{O}_2$, where $0 \leq x \leq 1$; $0 \leq y \leq 1$; Al_2O_3 ; Cr_2O_3 ; MgO ; MgAl_2O_4 ; and combinations thereof; and
heat-treating the mixture to prepare a surface/chemically modified LiMn_2O_4 electrode material.

Claim 22 (withdrawn): The method of claim 20, wherein the heat-treating is performed at a temperature in the approximate range of 100°C to 1000°C .

Claim 23 (withdrawn): The method of claim 20 wherein the heat-treating is performed for approximately 1 to 24 hours.

Claim 24 (withdrawn): The method of claim 20, wherein the surface/chemical modification material is in the approximate range of 1 to 20 weight percent of the surface/chemically modified LiMn_2O_4 electrode material.

Claim 25 (currently amended): An electrode material comprising a surface/chemically modified LiMn_2O_4 spinel oxide said electrode material prepared by a process comprising:

- a) refluxion of a precursor solution in glacial acetic acid, wherein the precursor is $\text{LiCo}_{0.5}\text{Ni}_{0.5}\text{O}_2$;
 - b) preparing a precursor solution in water, wherein the precursor is selected from a group consisting of Al_2O_3 ; Cr_2O_3 ; MgO , and MgAl_2O_4 ;
 - c) dispersing LiMn_2O_4 spinel oxide in the precursor solution; and
 - d) heating the dispersed LiMn_2O_4 spinel oxide to approximately 100 to 500 degrees C;
- and
- e) firing the heated dispersed LiMn_2O_4 spinel oxide at 500 to 900 degrees C.

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Claim 26 (withdrawn): A method of preparing an electrode material for lithium-ion batteries comprising:

supplying a LiCoO_2 layered oxide electrode material;
mixing the LiCoO_2 layered oxide electrode material with a surface/chemical modification material selected from a group consisting of Al_2O_3 ; Cr_2O_3 ; MgO , MgAl_2O_4 ; $\text{Li}_{1+x}\text{Mn}_{2-x-y}\text{M}_y\text{O}_4$ where $0 \leq x \leq 0.33$, $0 \leq y \leq 2$ and $\text{M} = \text{Ni}$ or Co ; and combinations thereof; and
heat-treating the mixture to prepare a surface/chemically modified LiCoO_2 electrode material.

Claim 27 (withdrawn): The method of claim 23, wherein the heat-treating is performed at a temperature in the approximate range of 100°C to 1000°C .

Claim 28 (withdrawn): The method of claim 23 wherein the heat-treating is performed for approximately 1 to 24 hours.

Claim 29 (withdrawn): The method of claim 25, wherein the surface/chemical modification material is in the approximate range of 1 to 20 weight percent of the surface/chemically modified LiCoO_2 electrode material.

Claim 30 (currently amended): An electrode material comprising a surface/chemically modified LiCoO_2 layered oxide said electrode material prepared by a process comprising:

- a) refluxion of a precursor solution in glacial acetic acid, wherein the precursor is $\text{Li}_{1+x}\text{Mn}_{2-x-y}\text{M}_y\text{O}_4$ where $0 \leq x \leq 0.33$, $0 \leq y \leq 2$ and $\text{M} = \text{Ni}$ or Co ;
 - b) preparing a precursor solution in water, wherein the precursor is selected from a group consisting of Al_2O_3 ; Cr_2O_3 ; MgO , and MgAl_2O_4 ;
 - c) dispersing LiCoO_2 layered oxide in the precursor solution; and
 - d) heating the dispersed LiCoO_2 layered oxide to approximately 100 to 500 degrees C;
- and
- e) firing the heated dispersed LiCoO_2 layered oxide at 500-900 degrees C.